EDITORIAL

TECHNOLOGICAL ADVANCEMENTS IN NEUROREHABILITATION

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It has been a few decades since neurological rehabilitation is recognized as a formal technique for therapeutic treatment of stroke patients or individuals suffering disabilities following spinal cord injuries. Despite the nervous system having a plasticity mechanism that facilitates spontaneous recovery to some extent, it is essential for most patients to receive specialized treatment protocol, to restore their motor function, including physical therapy and occupational therapy. More recently, experts of neurological rehabilitation have inculcated specialized therapies making use of computer and electronic devices to positively influence cortical excitability of damaged parts of cerebral hemispheres in order to improve neuroplasticity.¹ The advancements aim to take advantage of the functionally preserved neuromuscular structures in compensating for the functions of the damaged areas as well as restoring function of the affected brain tissue; something for which the use of technology was not seen being implemented around two decades back.^{1,2}

While traditional approach to neuro-rehabilitation would focus on preventing worsening of a functional limitation through exercises such as passive range of motion and stretching,² a better understanding of neuroplasticity has swung the rehabilitation pendulum in favor of use of several electrotherapeutic devices including transcranial magnetic stimulation modality, robot for limb training, robotic lower extremity orthoses and brain-computer interfaces which offer benefits for patients with neuronal injury.¹ Non-invasive brain stimulation facilitates perceptual learning as well motor and cognitive performance in case of brain lesions.²

In order to ensure adherence to various therapies in the process of rehabilitation, interactive treatment strategies are being developed. These include the application of virtual and augmented reality systems which not only motivate the patient but make the repetitive exercise interesting in a controlled environment.^{3,4} This approach has challenged the traditional paradigm by the use of biosensors as biofeedback tools to enlighten the patients about internal activities by them visualizing their muscle activity eventually helping them control their bodies better by knowing which muscles to contract to produce the correct movement.⁵ A proven successful mode of rehabilitation includes virtual reality (VR) technology, which is practical to use at homes, however, requires professional input when it comes to software development and application. Along with ensuring safety and effectiveness, new strategies are being developed which would allow clinicians who do not hold programming expertise to create game-based VR tasks and make further advancements in the field of neurological rehabilitation.⁶

Amongst the many causes of disability including trauma and musculoskeletal degenerative changes, nervous system disorders are most prevalent resulting in physical, cognitive, linguistic and behavioral issues all at the same time. According to a report by World Health Organization in year 2006, up to 1 billion people are suffering from neurological disorders worldwide constituting around 6% of the global burden of disease and is only escalating since then. Lower-income countries are significantly more affected than high-income countries as 80% disability-stricken individuals live in low-income countries.⁷ Considering rehabilitation, particularly the neurological aspect, as being relatively young medical specialty, improvement have been made in the years especially in the developed world with better quality rehabilitation services being offered by multidisciplinary teams consisting of highly trained physicians and physical therapists along with supporting staff.⁸

We are gradually, however, surely moving in the direction of figuring out new and effective approaches to neurorehabilitation by not only compensating for disabilities following neurological injuries but trying to reduce

impairments by restoring neuronal structure and function.² The technological advancements made in the developing countries are slow paced; however, keeping in mind the available resources, the responsibility lies with the clinicians to select and provide a comprehensive rehabilitation program which cost-efficient and easy to implement in the long run⁹. In a nutshell, a truly effective neuro-rehabilitative program would focus on strategies to fully enable an individual to carry out activities of daily life, increase mobility, improve the ability to function independently and be an integral part of society.

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